COUPLED LAND/ATMOSPHERE INTERACTIONS IN THE WEST AFRICAN MONSOON

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Rainfall in sub-Saharan West Africa is concentrated in a rainy season beginning in summer whose arrival is of critical importance for local economies. Intensive study of synoptic-scale disturbances over central and West Africa and the tropical Atlantic has revealed the existence of two types of westward propagating fluctuations. The first are the African Waves with zonal wavelengths of 2,500-3,000 km, periods of 3-5 days, and westward speeds of 9-10 m/s and which are most evident in the meridional component of winds. The second type has longer 6-9 day periods, correspondingly longer 6000 zonal wavelengths, and higher 11m/s speeds. These latter fluctuations are confined to the latitude band 10-20N. Here we provide the first documentation based on satellite measurements of a separate biweekly oscillation in rainfall that precedes the rainy season. Our analysis is based on surface wind observations from the SeaWinds scatterometer aboard the QuickSCAT satellite and tropical rainfall estimates based on a combination of the TRMM Microwave Imager, the Precipitation Radar and the five-channel Visible Infrared Scanner. The wind field of the tropical Atlantic consists of a convergence of trade winds from the Northeast and from the Southeast known as the Intertropical Convergence Zone. Strong rainfall patterns are associated with this narrow band of convergence. During late May the Intertropical Convergence Zone lies between the equator and 8N. However, the winds spanning the 10-day period beginning May 20 reveal a reversal of the normal trade wind systems between the equator and 10N and from 25W to the Greenwich meridian. This change brings moist maritime air eastward onto the Sahel region of Northwest Africa and strong convective activity over the continent and neighboring ocean. Time series of the zonal winds off Northwest Africa reveal that this wind disturbance is one of a succession of disturbances that develop first close to the equator in April and follows the northward march of the Intertropical Convergence Zone to 10N in mid-summer. We confirm these results by comparing them to the independent NCEP/NCAR reanalysis of *Kalnay et al. (1996*). We then use the reanalysis data to show that an increase of 1C surface temperature in the Sudan and coastal regions of the Gulf of Guinea precedes continental rainfall. This increase in surface temperature is followed by a decrease in the zonal air pressure gradient and a corresponding change in the strength of the trade winds by up to 8m/s, as well as the enhancement of rainfall by up to 0.8 mm/hour. In response to the shading and evaporative cooling effects due to rain the surface temperature drops. As the surface temperature decreases the trade winds resume their normal configuration. Thus the biweekly oscillations are revealed to be the result of land/atmosphere interactions.